The scattered radiation grid generally has a specific collimator system in the form of a lamella arrangement, so that X-ray quanta of the emitted measurement X-ray radiation which strike the lamella walls are also absorbed.

The provision of a scattered radiation grid accordingly means that a certain percentage of the radiation quanta of measurement X-ray radiation which is emitted for measurement purposes is absorbed in the scattered radiation grid, and can thus no longer be detected by the detectors.

In consequence, the intensity of the radiation emitted for measurement purposes must be increased appropriately, owing to the scattered radiation grid.

In medical applications, this unavoidably leads to an increased patient dose.

Furthermore, the scattered radiation can frequently also not be sufficiently well suppressed by the provision of a scattered radiation grid.

The object of the present invention is to provide a computer tomograph and a method for verification of X-ray radiation by means of a detector unit which comprises large number of detectors and in which the adverse effect on the measurement result caused by scattered radiation quanta or hardening effects is easily and reliably avoided.

The object is achieved as claimed in the independent claims, and the invention is developed in the dependent claims.

The object is achieved by a computer tomograph having a detector unit which comprises a large number of

detectors for verification of X-ray radiation, wherein the individual detectors are equipped to receive impinging

X-ray quanta of the X-ray radiation, and to detect both the intensity and the quantum energy of the individual X-ray quanta in the received, incident X-ray radiation.

Since the detectors in the detector unit in the computer tomograph according to the present invention are designed to receive incident X-ray radiation and to detect the intensity and the quantum energy of the individual X-ray quanta in the received X-ray radiation, a spectrum is emitted at the output of the detectors in the detector unit, instead of a single measured value per measurement period, which spectrum contains not only information about the number of X-ray quanta of medium quantum energy (intensity) received per measurement period, but also information about the respective quantum energy of the X-ray quanta (the spectrum) in the received X-ray radiation.

The information obtained in this way can be used to further suppress influences caused by scattered radiation, in addition to a scattered radiation grid which may be provided.

Furthermore, by analysis of the spectrum obtained, it is possible particularly reliably to detect hardening effects in the received X-ray radiation, such as those which occur at bone edges, on the basis of the shift in the spectrum of the received X-ray radiation. The hardening effects detected in this way can then be taken into account, and possibly corrected, appropriately in the further processing of the information obtained from the detectors in the detector unit.

Furthermore, during the further processing of the information obtained from the detectors in the detector unit, it is advantageous that a quantitative evaluation

quantum energy within a threshold value range can then easily be calculated from the difference between the counts of two comparators with adjacent threshold values. In this case, use is made of the correlation of the counting rates of counters, so that the statistical error does not rise during the subtraction process.

The threshold values of the comparators are preferably freely variable, so that the computer tomograph according to the invention can be matched to different measurement objects to be analyzed, and to different measurement methods.

The information obtained from the detectors in the detector unit can be processed further particularly easily by the detectors in the detector unit having a large number of pulse logic devices. The pulse logic devices provide time normalization of the output signals from the comparators. In this case, one pulse logic device is in each case connected downstream from each of the comparators, and is connected upstream of each of the counters.

According to one particularly preferred embodiment, the computer tomograph according to the invention also has a radiation source for emission of X-ray radiation with a predetermined intensity and a predetermined spectrum, a transmission device for transmission of the information detected by the detectors in the detector unit to an evaluation device, an evaluation device and which is designed to use the information detected by the detectors in the detector unit to calculate a measurement result from a measurement object through which the X-ray radiation has passed, taking into account the intensity and the spectrum of the X-ray radiation emitted from the radiation source.

With a design such as this, by comparison of the intensity and of the spectrum of the X-rays emitted from a radiation source with the intensity and spectrum of the X-rays received by the detectors of the

X-ray quanta with a specific quantum energy is also detected by all the counters with a lower threshold value. The number of X-ray quanta with a quantum energy within a threshold value range can then easily be calculated from the difference between the counts of the counters of two comparators with adjacent threshold values.

It is also advantageous for a signal which is produced in the detector as a consequence of a received X-ray quantum to be rejected if the determined signal level of the signal is lower than a lowest threshold value.

Another particularly advantageous feature of the method according to the invention is for the threshold values to be freely variable.

According to one particularly preferred embodiment, the method according to the invention also comprises the following steps:

- transmission of the information obtained by means of the detectors to an evaluation device;
- calculation of a measurement result from a measurement object through which the X-ray radiation has passed, by means of the evaluation device on the basis of the information detected by the detectors and taking into account the intensity and the spectrum of the X-ray radiation emitted from a radiation source.

A method such as this makes it possible to correct for scattered radiation influences and hardening effects in a particularly simple and reliable manner by comparison of the intensity and of the spectrum of the X-ray radiation which is emitted from a radiation source with the intensity, as detected by the detectors in the detector unit, and the spectrum of the received X-ray radiation, and thus to calculate a particularly detailed measurement result from a measurement object being analyzed.

Patent Claims

1. A computer tomograph, having a detector unit (2), which comprises a large number of detectors (1), for verification of X-ray radiation (40), with the individual detectors (1) in the detector unit (2) being designed in order to receive incident X-ray quanta of the X-ray radiation (40), and to detect both the intensity and the quantum energy of the individual X-ray quanta in the received X-ray radiation (40).

2. The computer tomograph as claimed in claim 1, characterized in that the detectors (1) in the detector unit (2) have a large number of parallel-connected comparators (131, 132, 133), each having a threshold value, and in that each comparator (131, 132, 133) has an associated counter (151, 152, 153), and the comparators (131, 132, 133) are designed to increment the respectively associated counter (151, 152, 153) by one unit when the quantum energy of an X-ray quantum in the received X-ray radiation (40) exceeds the threshold value of the respective comparator (131, 132, 133).

3. The computer tomograph as claimed in claim 2, characterized in that the threshold values of the comparators (131, 132, 133) are freely variable.

4. The computer tomograph as claimed in claim 2 or 3, characterized in that the detectors (1) in the detector unit (2) have a large number of pulse logic devices (141, 142, 143), with one pulse logic device (141, 142, 143) in each case being connected downstream from the respective comparators (131, 132, 133), and upstream of the respective counters (151,153) and that the pulse logics

(141, 142, 143) cause a time normalizing of the output signals of the comparators (131, 132, 133).

5. The computer tomograph as claimed in one of the preceding claims,
characterized
in that the computer tomograph also has:
- a radiation source (41) for emission of X-ray radiation (40) with a predetermined intensity and a predetermined spectrum;
- a transmission device (43) for transmission of the information detected by the detectors (1) in the detector unit (2) to an evaluation device (44);
- an evaluation device (44) which is designed to use the information detected by the detectors (1) in the detector unit (2) to calculate a measurement result from a measurement object (42) through which the X-ray radiation (40) has passed, taking into account the intensity and the spectrum of the X-ray radiation (40) emitted from the radiation source (41).

6. The computer tomograph as claimed in one of the preceding claims,
characterized
in that the detectors (1) in the detector unit (2) have a receiving area (3) for the X-ray radiation (40), which receiving area (3) is formed from gadolinium-oxysulfide ceramic, bismuth germanium oxide or lutetium oxyorthosilicate.

7. The computer tomograph as claimed in one of claims 1 to 5,
characterized
in that the detectors (1) in the detector unit (2) have a direct-conversion receiving area (3) for the X-ray radiation (40), which receiving area (3) is formed from cadmium zinc telluride or cadmium telluride.

8. A method for verification of X-ray radiation by

means of a computer tomograph having a detector unit (2) comprising a large number of detectors (1)

for which the X-ray radiation (40), received by means of a detector (1) of the detector unit (2) is detected both with respect to the intensity and the quantum energy of the individual X-ray quanta in the received X-ray radiation (40).

9. The method for verification of radiation as claimed in claim 8,
characterized
in that the detection of the X-ray quanta which are received by means of the detector (1) in the detector unit (2) comprises the following steps:

- detection of a signal which is produced in the detector (1) as a consequence of a received X-ray quantum, whose signal level is proportional to the quantum energy in the received X-ray quantum;
- comparison of the signal level with a large number of predetermined threshold values;
- incrementation of a counter (151, 152, 153), which is in each case associated with one range between two adjacent threshold values, by one unit when the signal level of the signal is in the range between the two adjacent threshold values.

10. The method for verification of radiation as claimed in claim 8,
characterized
in that the detection of the X-ray quanta which are received by means of the detector (1) in the detector unit (4) comprises the following steps:

- detection of a signal which is produced in the detector (1) as a consequence of a received X-ray quantum, whose signal level is proportional to the quantum energy in the received X-ray quantum;
- comparison of the signal level with a large number of predetermined threshold values;
- incrementation of counters (151, 152, 153), which are each associated with one threshold value, by one unit when the signal level of the signal exceeds the

respective threshold value.

11. The method for verification of radiation as claimed in claim 9 or 10,
characterized
in that a signal which is produced in the detector (1) as a consequence of a received X-ray quantum is rejected if the determined signal level of the signal is lower than a lowest threshold value.

12. The method for verification of radiation as claimed in claim 9, 10 or 11,
characterized
in that the threshold values are freely variable.

13. The method for verification of radiation as claimed in one of claims 8 to 12,
characterized
in that the method also comprises the following steps:
- transmission of the information obtained by means of the detectors (1) to an evaluation device (44);
- calculation of a measurement result from a measurement object (42) through which the X-ray radiation (40) has passed, by means of the evaluation device (44) on the basis of the information detected by the detectors (1) and taking into account the intensity and the spectrum of the X-ray radiation (40) emitted from a radiation source (41).